Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.55493/5002.v13i12.4889
Vol. 13, No. 12, 913-922.

URL: www.aessweb.com

Does the random walk hypothesis hold for Indian stock markets during parliamentary elections?

Khemraj Alias Sangam Shet[1+]
SriRam Padyala[2]
Ramesh Bommadevara[3]

[1,2,3]*Goa Business School, Goa University, Taleigao Plateau, Goa, India.*
[1]*Email: sangamdesai49@gmail.com*
[2]*Email: padyalasriram@unigoa.ac.in*
[3]*Email: brames@rediffmail.com*

(+ Corresponding author)

Article History
Received: 5 January 2023
Revised: 10 June 2023
Accepted: 8 September 2023
Published: 2 October 2023

Keywords
Adaptive market hypothesis
Efficiency
Inefficiency
Parliamentary elections
Random walk hypothesis
Stock market
Variance ratio test.

JEL Classification:
E22; F52; G10; G11; G12; G14.

ABSTRACT

In this study, we examine the random walk hypothesis for two well-known Indian indices, BSE (Sensex) and NSE (Nifty), by considering country-specific political events (parliamentary elections). Two pertaining questions were studied. First, efficiency with respect to weak form, semi-strong form, and strong form; and second, the random walk pattern of the return by applying the new variance ratio tests. We use 21 years of daily closing stock price data of both the National Stock Exchange (NSE) Nifty Index and the Bombay Stock Exchange (BSE) Sensex Index. The hypothesis is tested by using both conventional and new variance ratio tests: The Lo–MacKinlay variance ratio test, the Chow–Denning test, and Wright's Rank and Sign test. All three tests report that the return does not follow the random walk for the full sample, suggesting the possibility of making gains by exploiting various investing strategies. It was found that both Indian indices follow the random walk hypothesis during the phase of parliamentary elections. This study contributes to the existing literature on the Efficient Market Hypothesis (EMH).

Contribution/Originality: This study contributes significantly to the existing literature by studying the relevance of the Efficient Market Hypothesis from the perspective of parliamentary elections by applying both conventional and new variance ratio tests on the Indian BSE (Sensex) and NSE (Nifty) stock indices.

1. INTRODUCTION

One of the contentious issues in finance for more than 60 years has been market efficiency since the seminal work of Malkiel and Fama (1970). An efficient market reflects all the available information in the prices. Making gains through picking winners will not be possible in the case of efficient markets (Pandey, 2003). The theory classifies the market into three forms—weak, semi-strong, and strong. The weak form reflects all past information, the semi-strong form reflects past and publicly available information, and the strong form reflects past, public, and private information (Roberts, 1967). There are a number of studies testing the Random Walk Hypothesis (RWH) of various markets across the world with different methodologies. Hoque, Kim, and Pyun (2007) studied eight emerging markets from Asia by implementing the conventional Lo–MacKinlay, Chow–Denning, and Wright's Rank and Sign tests, and except for Taiwan and Korea, they reported that the Asian markets do not follow a random walk. Smith, Jefferis, and Ryoo (2002) tested whether South Africa's five medium-sized markets follow a random walk using the multiple variance ratio tests and the Chow–Denning test. The hypothesis was rejected in seven of the markets, but the South African market's stock price index was found to follow the random walk hypothesis. Charles and Darné (2009) evaluated the random walk by testing the martingale difference hypothesis using daily and weekly nominal exchange rates to examine the return predictability of key foreign currency rates. They proved that the return predictability of foreign exchange rates varies based on shifting market hypotheses. Gradojević, Djaković, and Andjelić (2010) investigated random walk theory in the Euro–Serbian dinar exchange rate market by using the conventional variance ratio test and a non-parametric sign-based test. Both categories of this test overwhelmingly rejected the random walk hypothesis. Chuluun, Eun, and Kiliç (2011) studied cross-currency and temporal variation in the random walk behavior in exchange rates using 29 floating bilateral USD exchange rates. They found that the higher the investment intensity, the less likely it is to reject the random walk hypothesis. Over the years, the view of the EMH has changed among researchers (Ito & Sugiyama, 2009). Recently, researchers have started to focus on a new hypothesis known as the Adaptive Market Hypothesis put forth by Andrew Lo, but the Efficient Market Hypothesis still remains relevant today. Several scholars have pursued the random walk hypothesis using various methodologies in the Indian context with conflicting results. Parthasarathy tested the random walk hypothesis of large capitalization, midcap, and small-cap indices for both daily and weekly data using the nonparametric rank and sign variance ratio test. The results showed that the Indian stock market has weak form efficiency. Dsouza and Mallikarjunappa (2015) conducted a run test, the augmented Dickey–Fuller (ADF) test, the Phillips–Perron test, and the GARCH(1,1) model using daily data from Bombay Stock Exchange 200 index-based companies; however, the findings did not support the weak form efficient market hypothesis. Jain, Vyas, and Roy (2013) used the daily closing prices of the Nifty, BSE CNX 100, and Standards and Poor (S&P) CNX 500 with both parametric and nonparametric tests for testing weak form efficiency. The results suggested that the Indian market has weak form efficiency. Mishra, Mishra, and Smyth (2015) used high-frequency financial data from the Indian stock market to test the efficient market hypothesis using the Narayan and Popp (2010) unit root test that allows for structural break results, indicating that stock indices are mean reverting. Poshakwale (2002) examined aggregated daily data by testing for the nonlinear dependence evidence that rejects the random walk hypothesis. Pandey (2003) used autocorrelation analysis to investigate the assumption that stock prices are random. He found that there are cheap assets in the market and that investors may gain excess returns by accurately selecting them. Gupta and Singh (2006) investigated weak form efficiency in Indian future markets and revealed the Indian equity futures market to be informationally inefficient. Kumar and Kumar (2017) investigated the Indian stock market in its weak form and found that stock prices do not represent all information and that there is a chance for abnormal gains. We study the same conflicting issue highlighted by various authors but by using the entire period and sub-periods over three decades by using both conventional and new variance ratio tests.

India has been one of the fastest emerging global financial markets and is expected to overtake the other developed countries' markets in the next decade, and there has been a keen interest among global investors in investing in the Indian stock market as part of their portfolio diversification. We employ the Chow–Denning multiple variance ratio test, which supersedes the Lo–MacKinlay variance ratio test's sequential procedure resulting in size distortions and ignores the joint nature of random walk (Hiremath & Kumari, 2014; Hoque et al., 2007) and Wright's Sign and Rank test, which does not resort to asymptotic approximations (Hoque et al., 2007). To the best of our knowledge, we are the first to apply the method used by Wright (2000) to both major Indian stock indices.

This paper uses 21 years of daily stock price data of both the National Stock Exchange (NSE) Nifty Index and the Bombay Stock Exchange (BSE) Sensex Index. The sample is divided into eight parts defined by parliamentary elections. The first objective for the study is to study how the market faired during the entire period and during the various eight sub-periods (parliamentary elections), whether it has become weak form efficient, semi-strong form efficient, or strongly efficient. The second objective is to ascertain the changes in the random walk pattern of the return by applying the new variance ratio test by Wright (2000).

The remaining sections of this paper are organized as follows: Section 2 describes the data and methodology, Section 3 presents and discusses the empirical results, and Section 4 summarizes and concludes.

2. DATA AND METHODOLOGY

For the study, daily index price data of the BSE Sensex Index and the NSE Nifty Index from January 1, 1998, to December 31, 2018, is used. The data was collected from Yahoo Finance. The above two indices were selected as they are the major indices of two different stock markets in India. We examine the sample periods from January 1, 1989, to July 13, 2020, for the BSE Sensex Index, and from July 3, 1990, to July 13, 2020, for the NSE Nifty Index. We also create eight sub-periods which are defined by parliamentary elections in the market trend. For the BSE, each of the eight sub-periods are divided into subsamples of four months: April 1 to July 31, 1991; March 1 to June 30, 1996; January 1 to April 30, 1998; August 1 to November 30, 1999; March 1 to June 30, 2004; March 1 to June 30, 2009; March 1 to June 30, 2014; and March 1 to June 1, 2019. For the NSE, seven sub-periods were divided into samples of four month each: March 1 to June 30, 1996; January 1 to April 30, 1998; August 1 to November 30, 1999; March 1 to June 30, 2004; March 1 to June 30, 2009; March 1 to June 30, 2014; and March 1 to June 1, 2019. The daily stock prices of the BSE and NSE indices were converted to the daily logarithmic returns using the following formula:

$$tR_t = Ln\left(\frac{p_t}{p_{t-1}}\right) * 100$$

2.1. Variance Ratio Test

Lo and MacKinlay (1988) proposed the variance ratio test based on the property that the variance of subsequent is a random walk and X_t is linear in its data interval. This means that the variance and mean of r_t -r_{t-1} are required to be twice the variance of r_t; therefore, the random walk hypothesis (RWH) can be checked by comparing of two periods' returns, $r_t(2) = r_t$-r_{t-1}, to twice the variance of a one-period return r_t. Then the variance ratio test is given as VR (2):

$$VR(2) = \frac{..Var[r_t(2)]}{2\,Var[r_t]} = \frac{Var[r_t + r_{t-1}]}{2\,Var[r_t]}$$

$$= \frac{..2Var[r_t] + 2\,Cov[r_t, r_{t-1}]}{2Var[r_t]}$$

$$VR(2) = 1 + p(1) \qquad (1)$$

Where p(1) is the first-order autocorrelation coefficient of return [r_t]. The RWH requires the autocorrelation to hold true when VR(2) = 1. The standard normal test statistic under the assumption of homoscedasticity is a random walk, and the variance ratio is expected to be equal to unity. This is given as:

$$Z(q) = \frac{(VR(q)-1)}{\sqrt{\emptyset(q)}} \sim N(0,1) \qquad (2a)$$

Where:

$$\emptyset(q) = \frac{2(2q-1)(q-1)}{3q(nq)} \qquad (2b)$$

The Lo–Mackinlay standard normal test for heteroscedasticity is given as:

$$Z * (q) = \frac{VR(q)-1}{\varphi * (q)^{\frac{1}{2}}} \qquad (2c)$$

The returns are considered random when the variance ratios at holding period q have unity. Here, a variance ratio of less than one implies a negative autocorrelation and a ratio greater than one indicates a positive autocorrelation.

2.2. Multiple Variance Ratio Tests

To overcome the drawback of size distortion as a result of the sequential procedure and joint nature of the random walk, Chow and Denning (1993) proposed multiple variance ratio tests. The variance ratio estimates {VR $_{(qi)}$i| =1,2,3,……, L} corresponding to a set of pre-defined numbers of lags [qi| I =1,2,3,….., L] are as follows:

$$H_{oi} = VR = 0 \; for \; i = 1,2, \ldots., m \qquad (3a)$$

$$H_{1i} = VR(q_i) \neq \; 0 \text{ for any I } = 1,2, \ldots., \text{m} \qquad (3b)$$

The rejection of H_{0i} will lead to the rejection of the Random Walk Hypothesis. The Chow–Denning test statistics are given as follows:

$$CD = \sqrt{T} \max_{1 \leq i \leq} |Z^*(qi)| \qquad (3c)$$

The Chow–Denning test statistic follows a studentized maximum modulus, SMM (α, m, T), distribution with m parameter and T degrees of freedom. The absolute value of the Chow–Denning individual variance ratio test statistics will determine the acceptance or rejection of the null hypothesis. If the standardized Chow–Denning test statistic is greater than the studentized maximum modulus (SMM) critical values at the chosen significance level, the RWH is rejected.

2.3. Non-Parametric Variance Ratio Tests

2.3.1. Rank-Based Variance Ratio Test

Four alternative tests are given by Wright (2000) based on ranks and signs to the parametric variance ratio test. Let $r(x_t)$ be the rank of x_t among $x_1, x_2, x_3, \ldots\ldots, x_t$, and the corresponding standardized (zero mean, unit variance) series r_{it} is given by:

$$r_{1t} = (r(x_t) - \tfrac{T+1}{2}) / \sqrt{\tfrac{(T-1)(T+1)}{12}} \qquad (4a)$$

Simply substitute r_{1t} with x_t in the definition of the test statistic Z_1 so that the proposed rank-based test statistic is:

$$R_1(k) = \left(\frac{\sum_{k+1}^{T}(r_{1t}+r_{1t-1}+\cdots+r_{it-k+1})^2}{k\,\sum_1^T r_{1t}^2}\right) X \left(\frac{2(2K-1)(K-1)}{3kT}\right)^{-\frac{1}{2}} \qquad (4b)$$

$$R*_1\,(k) = \left(\frac{\sum_{k+1}^{T}(r_{1t}^*+r_{1t-1}^*+\cdots+r_{1t-k+1}^*)^2}{k\,\sum_1^T r_{1t}^{*2}}\right) X \left(\frac{2(2K-1)(K-1)}{3kT}\right)^{-\frac{1}{2}} \qquad (4c)$$

2.3.2. Sign-Based Variance Ratio Test

The sign-based variance ratio test statistic S_1 is defined as:

$$s_1 = \left(\frac{\frac{1}{Tk}\sum_{t=k}^{T}(s_1+s_{t-1}\ldots+s_{t-1k+1})^2}{\frac{1}{T}\sum_{t=1}^{T}s_t^2} - 1\right) x \left(\frac{2(2k-1)(k-1)}{3kT}\right)^{-1/2} \qquad (5a)$$

3. EMPIRICAL RESULTS

Table 1 describes the basic statistics for the daily returns of the BSE (Sensex) Index and the NSE (Nifty) Index. The mean return is positive for the full sample period and the subsample periods, whereas it is negative for BSE and NSE subsamples III and V. The mean returns are higher for the BSE Sensex and the NSE Nifty for subsample VI (March 1 to June 30, 2009), which precedes the 2008 financial crisis for both indices. Higher volatility was reported for subsamples III, V and VI. Interestingly, before and after the financial crisis, both parliamentary elections were volatile, but the latter period exhibited higher volatility. Skewness is negative for the full sample, subsample III, and subsample V, whereas it is positive for all other subsamples for both indices, implying that the returns are flatter to the left for the full sample, subsample III and subsample V compared to the normal distribution. Kurtosis indicates a sharp peak of the return's distribution compared to a normal distribution. The peakedness was higher after the financial crisis for both indices.

Table 1. Descriptive statistics for the daily returns of the BSE (Sensex index) and the NSE (Nifty index) with respective subsamples.

	Mean	Median	Std. dev.	Skewness	Kurtosis	JB
Sensex	0.0527	0.0786	1.64	-0.16	7.20	16398
BSE I	0.4197	0.4781	1.68	0.04	0.19	0.3157
BSE II	0.1204	0.3074	1.35	0.21	-0.26	0.6962
BSE III	-0.2708	-0.2679	2.28	-0.60	1.23	6.4128
BSE IV	0.0319	-0.1538	1.60	0.37	1.74	13.905
BSE V	-0.2090	0.0230	2.24	-1.40	8.74	316.70
BSE VI	0.6728	0.4977	2.79	2.03	9.59	380.24
BSE VI	0.2436	0.0901	0.82	0.70	0.50	7.8434
BSE VIII	0.1212	0.1673	0.84	0.82	2.33	29.205
Nifty	0.0427	0.0849	1.54	-0.23	7.29	10539
NSE II	0.1253	0.0204	1.41	0.36	0.09	2.0024
NSE III	-0.2596	-0.3092	2.21	-0.09	1.19	6.1405
NSE IV	0.0871	-0.0654	1.60	0.33	1.41	9.7682
NSE V	-0.2196	-0.0385	2.47	-1.65	8.95	342
NSE VI	0.6130	0.4412	2.75	2.22	11.29	514.95
NSE VII	0.2527	0.1239	0.82	0.67	0.54	7.6706
NSE VIII	0.1116	0.0470	0.84	0.79	2.21	0.9480

3.1. Variance Ratio Test

Table 2 demonstrates the variance ratio estimates and test statistics of RWH, either assuming homoscedasticity or heteroscedasticity for the entire sample period and subsample periods before and after for both indices based on the Lo and MacKinlay (1988) methodology. The BSE (Sensex) full sample indicates that the shorter horizon RWH is rejected, whereas for the longer horizon it holds. For most of the BSE subsamples and the values of q, the RWH holds.

Nevertheless, for subsample VII, from March 1 to June 30, 2014, the evidence of random walks starts disappearing for the shorter investment holding horizon, whereas for longer periods it still holds. For the NSE full sample, the result indicates rejection of the null hypothesis as the variance ratio is not statistically different from one, except for $q = 8$ and $q = 16$. We can reject the random walk hypothesis for stock returns for shorter investment horizons. For most of the NSE subsamples and the values of q, the random walk hypothesis holds, except for subsample VII, from March 1 to June 30, 2014, where the random walk hypothesis is rejected for shorter investment horizons, i.e., $q = 2$ and $q = 4$.

Both the indices reflect a similar movement, with rejection of the random walk hypothesis for the full sample and acceptance for the rest of the subsample periods, except subsample VII, from March 1 to June 30, 2014, where the 16th parliamentary elections saw a regime change in India. Given that the data are characterized by changing volatility, based on the value of $Z^*(q)$, we conclude that the results for the full BSE and NSE samples are not as strong for longer investment horizons ($q = 8$, $q = 16$ days), but the random walk hypothesis is still rejected for $q = 2$ and $q = 4$.

The pre- and post-financial crisis results are the same for both the BSE and the NSE, indicating that the level and the quality of activity in the Indian market remain the same. For all the BSE and NSE subsamples that are represented by the period of parliamentary elections, the random walk hypothesis holds, except for subsample VII, where it is rejected for shorter horizons. It is therefore concluded that the predictability of returns remains for shorter horizons, and it vanishes for longer periods as the holding period increases.

Table 2. Lo–MacKinlay variance ratio test statistics of the RWH.

Number of lags (Q)						
			Q = 2	Q = 4	Q = 8	Q = 16
BSE	Full sample	VR(q)	1.03	1.04	1.05	1.08
		Z(q)	(3.02**)	(2.30**)	(1.38)	(1.48)
		Z*(q)	[1.79**]	[1.40]	[0.87]	[0.97]
	Subsample I	VR(q)	0.988	1.042	0.992	0.828
		Z(q)	(-0.100)	(0.200)	(-0.020)	(-0.341)
		Z*(q)	[-0.809]	[0.171]	[-0.022]	[-0.339]
	Subsample II	VR(q)	1.111	1.106	1.141	0.891
		Z(q)	(0.983)	(0.504)	(0.422)	(-0.217)
		Z*(q)	[1.186]	[0.560]	[0.443]	[-0.227]
	Subsample III	VR(q)	0.973	0.809	0.622	0.601
		Z(q)	(-0.242)	(-0.950)	(-1.190)	(-0.844)
		Z*(q)	[-0.290]	[-0.942]	[-1.134]	[-0.822]
	Subsample IV	VR(q)	1.019	1.013	0.819	0.635
		Z(q)	(0.173)	(0.064)	(-0.556)	(-0.755)
		Z*(Q)	[0.132]	[0.051]	[-0.478]	[0.697]
	Subsample V	VR(Q)	0.994	0.748	0.657	0.577
		Z(Q)	(-0.047)	(-1.241)	(-1.066)	(-0.884)
		Z*(Q)	[-0.01]	[-0.547]	[-0.574]	[-0.582]
	Subsample VI	VR(Q)	1.031	0.787	0.557	0.493
		Z(Q)	(0.283)	(-1.011)	(-1.329)	(-1.023)
		Z*(Q)	[0.419]	[-1.292]	[-1.550]	[-1.141]
	Subsample VII	VR(Q)	1.217	1.114	1.040	0.544
		Z(Q)	(1.961**)	(0.549)	(0.123)	(-0.911)
		Z*(Q)	[1.633**]	[0.473]	[0.116]	[-0.925]
	Subsample VIII	VR(Q)	1.006	1.003	1.062	0.723
		Z(Q)	(0.056)	(0.014)	(0.188)	(-0.558)
		Z*(Q)	[0.014]	[0.012]	[0.178]	[-0.539]
NSE	Full Sample	VR(Q)	1.063	1.053	1.025	1.075
		Z(Q)	(4.378**)	(1.964**)	(0.583)	(1.177)
		Z*(Q)	[2.511**]	[1.163]	[0.360]	[0.761]
	Subsample II	VR(Q)	1.057	1.000	1.072	0.862
		Z(Q)	(0.502)	(0.003)	(0.222)	(-0.284)
		Z*(Q)	[0.495]	[0.003]	[0.217]	[-0.278]
	Subsample III	VR(Q)	0.999	0.809	0.615	0.585
		Z(Q)	(-0.000)	(-0.949)	(-1.213)	(-0.878)
		Z*(Q)	[-0.000]	[-0.953]	[-1.151]	[-8.514]
	Subsample IV	VR(Q)	1.022	0.970	0.816	0.664
		Z(Q)	(0.208)	(-0.145)	(-0.571)	(-0.703)
		Z*(Q)	[0.163]	[-0.119]	[-0.505]	[-0.654]
	Subsample V	VR(Q)	1.081	0.843	0.711	0.610
		Z(Q)	(0.748)	(-0.771)	(-0.900)	(-0.815)
		Z*(Q)	[0.272]	[-0.323]	[-0.463]	[-0.518]
	Subsample VI	VR(Q)	0.990	0.796	0.617	0.564
		Z(Q)	(-0.083)	(-0.964)	(-1.150)	(-0.878)
		Z*(Q)	[-0.129]	[-1.357]	[-1.471]	[-1.039]
	Subsample VII	VR(Q)	1.245	1.185	1.110	0.569
		Z(Q)	(2.210**)	(0.890)	(0.335)	(-0.880)
		Z*(Q)	[1.899**]	[0.784]	[0.321]	[-0.901]
	Subsample VIII	VR(Q)	1.006	0.984	1.021	0.672
		Z(Q)	(0.059)	(-0.073)	(0.065)	(-0.661)
		Z*(Q)	[0.050]	[-0.67]	[0.062]	[-0.638]

Note: The variance ratios for q-day returns, VR(q), are reported in the first row. Z(q) variance ratio test statistics assuming homoscedasticity are reported in parentheses (). Z*(q) variance ratio test statistics, heteroscedasticity-consistent, are reported in brackets [ ]. Under the null of random walk, the variance ratio value is expected to equal one. ** denotes significance at the 5% level. * denotes significance at the 10% level.

Table 3. Wright's non-parametric variance ratio test statistics of the RWH using the rank and sign test and the multiple variance ratio test by Chow and Denning (1993).

		K	R_1	R_2	S_1	$Z_1(q)$	$Z_2(q)$
BSE	Full sample	2	5.382	4.501	4.208	3.029*	1.79
		4	3.974	3.336	3.447		
		8	2.787	2.090***	3.228		
		16	2.406	1.907***	3.413		
	Subsample I	2	-0.355**	-0.176**	-0.113**	0.344	0.339
		4	-0.286**	-0.031**	0.000**		
		8	-0.140**	0.218**	0.481**		
		16	-0.340**	-0.475**	0.213**		
	Subsample II	2	1.039**	0.946**	0.000**	0.983	1.186
		4	0.610**	0.560**	0.181**		
		8	0.415**	0.376**	0.421**		
		16	-0.399**	-0.313**	0.308**		
	Subsample III	2	0.578**	0.141**	1.393**	1.190	1.134
		4	0.109**	-0.387**	1.432**		
		8	-0.642**	-0.899**	0.271**		
		16	-0.468**	-0.628**	-0.115**		
	Subsample IV	2	0.394**	0.297**	0.329**	0.755	0.697
		4	-0.199**	-0.350**	0.234**		
		8	-0.679**	-0.519**	-0.519**		
		16	-0.904**	-0.660**	-1.165**		
	Subsample V	2	0.131**	0.375**	-0.542**	1.240	0.582
		4	-0.601**	-0.551**	-0.869**		
		8	-0.996**	-0.834**	-1.521***		
		16	-1.083**	-0.965**	-1.441***		
	Subsample VI	2	0.002**	-0.048**	-0.562**	1.329	1.550
		4	-0.716**	-1.021**	0.060**		
		8	-0.839**	-1.273**	0.931**		
		16	-0.613**	-0.996**	1.386**		
	Subsample VII	2	1.603	1.628	0.777**	1.961	1.633
		4	0.323**	0.426**	0.653**		
		8	0.031**	0.141**	0.976**		
		16	-1.009**	-0.943**	0.725**		
	Subsample VIII	2	-0.280**	0.079**	0.562**	0.558	0.539
		4	-0.194**	-0.089**	0.721**		
		8	-0.036**	0.107**	0.798**		
		16	-0.504**	-0.526**	0.274**		
NSE	Full Sample	2	5.542	4.913	4.633	4.378*	2.511*
		4	4.216	3.073	4.461		
		8	2.954	1.671**	4.071		
		16	2.511	1.593**	3.214		
	Subsample II	2	0.855**	0.647**	0.109**	0.520	0.495
		4	0.503**	0.125**	0.234**		
		8	0.526**	0.235**	0.482**		
		16	-0.275**	-0.253**	-0.629**		
	Subsample III	2	0.708**	0.487**	0.964**	1.213	1.151
		4	0.151**	-0.351**	0.515**		
		8	-0.424**	-0.854**	0.724**		
		16	-0.270**	-0.600**	0.316**		
	Subsample IV	2	0.306**	0.330**	0.108**	0.703	0.654
		4	-0.071**	0.019**	0.231**		
		8	-0.555**	-0.439**	-0.238**		
		16	-0.781**	-0.586**	-1.053**		
	Subsample V	2	0.632**	0.759**	-0.108**	0.900	0.518
		4	-0.081**	-0.147**	-0.521**		
		8	-0.593**	-0.566**	-1.411**		
		16	-1.003**	-0.948**	-1.342**		
	Subsample VI	2	-0.516**	-0.373**	-1.462**	1.150	1.471
		4	-0.945**	-0.980**	-1.262**		
		8	-0.807**	-0.986**	-0.494**		
		16	-0.696**	-0.834**	-0.511**		
	Subsample VII	2	1.811	1.883	1.222	2.210*	1.899
		4	0.690**	0.681**	1.247		
		8	0.318**	0.303**	1.727		
		16	-0.849**	-0.873**	1.293**		
	Subsample VIII	2	-0.180**	0.118**	-0.337**	0.661	0.638
		4	-0.337**	-0.280**	0.360**		
		8	-0.252**	-0.128**	0.380**		
		16	-0.689**	-0.687**	-0.083**		

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.
The critical values were simulated with 10,000 replications in each case.
Critical values were used for decision making for all cases, the values of *K* used are 2, 4, 8, and 16.

3.2. Wright's Non-Parametric Variance Ratio Test Statistics and Multiple Variance Ratio Test

Table 3 presents the results of Wright's sign and rank test. We follow the rule in Hoque et al. (2007) for making inferential decisions using these statistics – if there are more than two rejections at any of two levels of significance (1% and 5%), we reject the null of the random walk hypothesis. For a full sample of the Sensex, S_1 is insignificant, whereas R_1 for k = 2, 4, 8, and 16, and R_2 for k = 2 and 4. For all Sensex subsamples, S_1 is significant for k = 2, 4, 8, and 16, R_1 for k = 2, 4, 8, and 16, and R_2 for k = 2, 4, 8, and 16. The full sample and Subsamples I and II of the Sensex reject the RWH. For the BSE full sample, all test statistics for different holding periods are insignificant, except for the R_2 for holding periods of 8 and 16. The rank-based test statistics are overwhelmingly rejected for q values ranging from 2 to 16 for the full sample, indicating that they do not follow the random walk hypothesis. For the rest of the subsamples, there is compelling evidence of the random walk hypothesis.

In the case of the Nifty full sample, S_1 is insignificant for all the k holding periods, and R_1 for k = 2, 4, 8, and 16, and R_2 for k = 2, 4, 8, and 16. For subsample I, S_1 is significant for k = 2, 4, 8, and 16, R_1 for k = 2, 4, 8, and 16, and R_2 for k = 2, 4, 8, and 16. It is thus apparent that the null of the RWH is rejected for all subsample periods, indicating that the market is not weak form efficient. All of these subsamples give rise to consistent inference. The full samples for the Sensex and the Nifty tend toward a weak form but both samples indicate that the market is not weak form efficient. The post-financial crisis subsamples indicate insignificance for shorter horizons for R = 2.

Table 3 reports Wright's non-parametric variance ratio test statistics for the RWH using the rank and sign test and the multiple variance test by Chow and Denning (1993). $Z_1(q)$ and $Z_2(q)$ of the Chow–Denning test statistics are reported for both the Sensex and Nifty and their subsamples. The Chow–Denning test results indicate the predictability of stock returns for the Sensex and the Nifty by rejecting null of the random walk for the full samples and subsample VII at the 5% significance level. The BSE Sensex and the NSE Nifty subsamples indicate non-dependency of returns, thus implying independence. The individual and multiple variance ratio tests suggest that the Indian market moves in various phases from efficient stages to inefficient stages. The returns during the period of parliamentary elections in India tend to be random.

4. CONCLUSION

This study examines the weak form efficiency of two major Indian stock market indices, the BSE Sensex and the NSE Nifty, using daily data for the 1998–2016 period and various sub-periods, which are classified based on parliamentary elections. The aim is to see whether sufficient gains can be made in returns by exploiting periods of political uncertainty. Various variance ratio tests were employed to determine whether the two major indices follow a random walk during parliamentary elections.

The tests implemented are the Lo–MacKinlay variance ratio test, the Chow–Denning multiple variance ratio test, and Wright's rank and sign test (Wright, 2000). While previous studies in the Indian context have reported weak form efficiency (Jain et al., 2013; Parthsarathy, 2016), Dsouza and Mallikarjunappa (2015) and Poshakwale (2002) reject weak form efficiency. This study reveals that the market is not weak form efficient and tends to be inefficient. The full samples reject the random walk hypothesis, whereas the various periods of parliamentary elections tend to be random.

However, the period of the 16th parliamentary election has indicated predictability, which also saw a regime change. This has not been reflected in the past when such a regime change happened on a smaller scale. It is possible that information spread has had an impact on the 16th parliamentary elections, as social media has become more widely used. Before and after the 2008 financial crisis, the market showed the same level of activity. This leaves scope for trading opportunities for technical analysts and other similar traders to make gains by deploying various trading strategies.

Funding: This study received no specific financial support.
Institutional Review Board Statement: Not applicable.
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Data Availability Statement: Upon a reasonable request, the supporting data of this study can be provided by the corresponding author.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript. All authors have read and agreed to the published version of the manuscript.

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APPENDIX

The appendix presents the figures of the daily closing price movements of the BSE (Sensex) and NSE (Nifty) and variance ratios at 95% confidence intervals at 5-, 10- and 15-day holding periods.

Figure 1 illustrates the daily closing price of the BSE (Sensex) from January 1, 1989, to July 13, 2020, and the NSE (Nifty) from July 3, 1990, to July 13, 2020. The sharp drop indicates the fall in the market due to the 2008 global financial crisis.

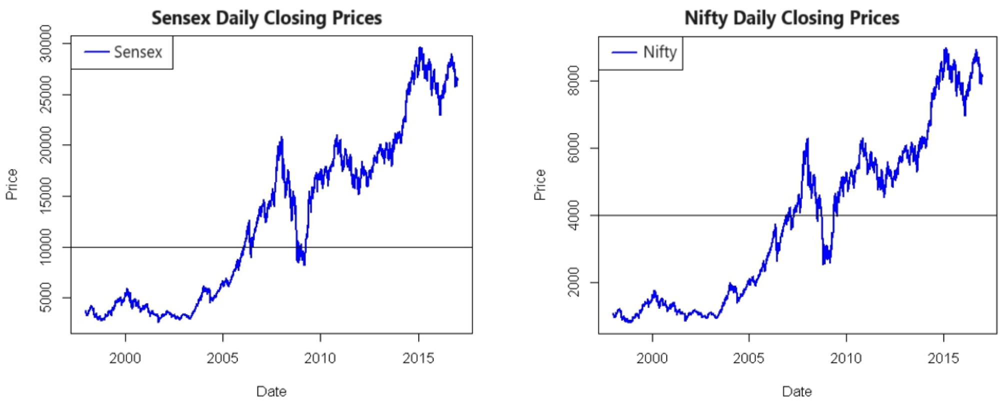

Figure 1. Time plots of the daily closing prices of the BSE (Sensex) and the NSE (Nifty) indices (full samples).

Figure 2 illustrates the variance ratios of the BSE (Sensex) from January 1, 1989, to July 13, 2020, and the NSE (Nifty) from July 3, 1990, to July 13, 2020, for holding periods q = 5, 10, and 15 at a 95% confidence band.

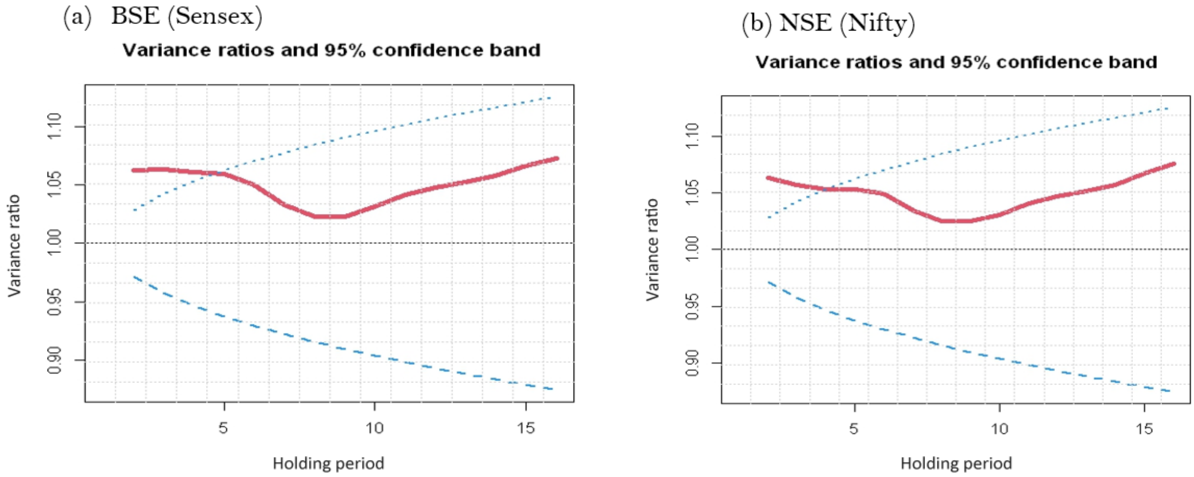

Figure 2. Variance ratio plots of the BSE (Sensex) and the NSE (Nifty) full samples at a 95% confidence interval.